book series

di id
disegno industriale › industrial design

The issue 67 of **di**id solicits reflections on the contemporary relationships between Design and Technologies; it investigates according to which directions has the design culture been confronted in recent years with the world of technical artifacts, deeply changed in relation to the evolution of areas such as digital electronics, robotics and AI. Post-human thinking has had a strong influence in stimulating research towards a conjugation between human and machine, where the contamination between the two dimensions is no longer seen as a threat but as a chance for co-existence and transformation.
With the confluence of mechanics and AI, nowadays the world of robotics comes to be particularly attractive to design; the research of robotics faces new limits through the development of complex devices capable of a wide range of tactile, visual, sound, and olfactory sensibilities. A deeply collaborative dimension between human and machine is perhaps the most "natural" promise for technological innovation, that will certainly have an impact on the future identity of design and on its creative processes.

Mario Buono, Francesca La Rocca

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Design and Technologies

67/19

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Phygital experiences design

In today fast-changing environment, ruled by the evolution of technologies, the designer is asked to act as configurator of an engaging process that sees the interaction between two main protagonists of these transformations: humans and machines.
To do this, is important to understand how to mix physical and digital processes inside a new dimension that is emerging more and more: the phygital one.
The investigation underlined the need to consider the cultural dimension as one of the main drivers that influence the interaction between humans and machines.
The cultural research was conducted among three dimensions: the physical, the digital and the phygital one.
In the physical dimension the cultural component appears to be evident; in the digital one was strongly reduced; finally, for the phygital dimension, the cultural component seems will play a major role.
The investigation, through case studies analysis, leads to noticing that inside this new kind of interaction is important to reposition the user at the center of the process.
The interaction between users and machines takes on different and unexpected combinations, considering that the technology is embedded in products and spaces. In fact, these seem to be more robotic due to the increasingly amplified technological component.
With new technologies, the structure almost disappears, the technological components are mostly embedded, and the communicative and interactive elements increase. This will use different formats and will follow new rules in relation to a renewed way of use and a different acceptance by users.
By exploring the main aspects that a designer should take into account in designing phygital experiences, the aim of this paper is to highlight new rules to be considered in this new context.

[phygital design, interaction design, user experience, cultural design]

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The culture in human-machine interaction
In a world where breakthrough technologies will continue to create new value and transform experiences for business and consumers alike, there are quite a few trends that are happening already. Technology is becoming more and more the protagonist, and the transformations coming from it require a redefinition of products, experiences and processes of interaction to be fully applied.

On one side, everything seems to become intelligent (or smart) and digital, on the other new features inherent in products and environments allow new forms of interaction.

In this scenario, driven by rapid technological developments, for designers, it is important to understand how to create new meaningful experiences and new dialogues between humans and machines, two entities that increasingly find themselves interacting and dialoguing.

Inside an "user-centered" approach influenced by the new development of technology, seems more and more important to position the users at the center of the process: "but how is it possible to do it? And which are the related implications?"

The interaction between humans and machines, when it is not just through a monitor (which create a flat interaction), opens to new dynamics that take into account and that are influenced by the culture of an individual. Languages, gestures change and personalize the way people and machines interact. Considering the design of the interaction, and in particular in the phygital ones, an understanding of the cultural values of different users is required. This is because the dialogue between human and machine is particularly amplified and a flat interaction valid for all is no longer acceptable.

For this reason, the research started from an analysis of the cultural dimension: "What is culture? How does it characterize each individual? What happens in acculturation phenomena when different cultures meet?"; then the research moved on to define the interaction and implications that culture generates on it when human and machine meet; finally, after the analysis phase, a set of aspects to be taken into consideration in the design of phygital interactions were developed.

Theoretical references
Culture
The word culture has a Latin derivative, which refers to the tilling of the soil. The culture is shared with and acquired by people who live in the same social environment and for this reason, is defined as part of a collective phenomenon. In humans, it is learned, not innate: it is the result of many actions (micro and macro) that each person does during their life.

Hofstede (1997) argue that culture "should be distinguished from human nature on one side and from an individual's personality on the other, although exactly where the borders lie between nature and culture, and between culture and personality, is a matter of discussion among social scientists".

Acculturation

The term acculturation was used for the first time in 1880 (Powell, cited in Herskovits, 1938), but the first famous formulation was theorized in 1936 from Redfield, Linton, and Herskovits "Acculturation comprehends those phenomena which result when groups of individuals from a different cultural background come into continuous first-hand contact, with subsequent changes".

Young Kim (1988, 2001), one of the main researchers in acculturation, developed an integrated model of cultural adaptation. She emphasizes a stress-adaptation-growth dynamic model that features the cyclic tension of constantly moving forward and drawing back in adaptation growth. Her model features the concepts of deculturation, acculturation, and assimilation:

. deculturation is the unlearning of at least some of one's past cultural elements;
. acculturation involves acquiring and learning some of the new cultural practices; responding at least partially to the pressure of the dominant culture;
. assimilation represents the "state of the highest degree of acculturation into the host milieu and deculturation of the original cultural habits".

Interaction

Interaction design, as discipline, is very difficult to define. Although people daily interact with different entities is not easy to define a common definition of this kind of involvement.

Interaction by the CTI reviews (2010) is defined as "the action that occurs as two or more entities have an effect upon one another to produce a new effect [...]".

Goikolea (2013) defines interaction as "the process in the machine that considers the point of the interaction process in which the user is involved at any given moment, and thus reacts to the user's actions and vice versa".

Interaction designers act as "co-creators of meaning" and "relationship architects": they choreograph the interactions.

The role of the *interaction designer*, for Bill Verplank (2007), consists in answering three questions:

- "How do you do?" consider the affordances the designer has to incorporate in the proposal;
- "How do you feel?" consider the feedbacks coming from the system involved in the interaction and the emotional consequences that they produce;
- "How do you know?" consider the path that should be shown to the users by the designer in order to help him to know what they are going to do with the product that he is coming in contact with.

The interaction design process should focus on users, through ideation and prototyping, and incorporating emotion, drawing on a wide range of influences (Saffer, 2009).

The implication of culture inside interactions
Physical interaction

Inside *The Design of Everyday Things*, Donald A. Norman (1988) describes that to design a positive interaction, it is important to consider several principles:

. affordance represents the perception of how to use an artifact. For example, menus suggest the action of choice, and buttons suggest pressing;
. conceptual models are mental models of a system, through which users can understand the system and the effects of their actions;
. the mapping shows the link between an action that is performed through the controls and the effects it has on the system. For example, moving the controller to the left should correspond to moving an object on the display to the left;
. the signifier in designing a system makes the conceptual model of the system and the actions they are allowed to take immediately obvious to users;
. the feedback shows the information produced by users' actions.

In designing a "good-designed" artifacts, Norman (1988) suggests that a well-designed interaction is recognizable because it allows every time the user to understand what to do, and at the same time give to the user the possibility to tell what is going on. In the research, the importance of the cultural factors that modify and characterize the physical interaction, was analyzed and underlined through the study of a series of values between different countries.

The religion, in relation to the different countries, has a diverse influence on everyday life. For instance, in the US it impacts only on one sphere of life, in Japan beliefs guide the entire everyday life and the way of understanding what surrounds people, while in Arab countries the religion conforms people in habits and customs.

Finally, one of the most important aspect also during the conceptualization of the interaction and that change according to the cultural sphere is the proxemics. In all the countries considered for the research, with the exception of the Arab world, physical contact between strangers or acquaintances is not welcome and often reduces to a handshake.

Digital interaction

The discussed Norman's guidelines (1988) that have been incorporated into the Nielsen Heuristic for User Interface Design (1995), can be extended and adopted also for the digital artifacts. In this study, digital artifacts are referred to the definition of Braman and James (2009):

a designed thing that embraces digitally encoded information content that is displayed on digital media or a combination of digital and physical components. The artifact acts as a materialization of a message while enhancing a perceptual experience on the user's side. (p. 25)

As for Norman's statements about the physical interactions, also the digital ones need to be understood by users in order to be considered goodly designed: this represents the first rule.

Löwgren and Stolterman (2004) affirm that:

the good of a particular digital artifact also has to be judged in relation to the intentions and expectations present in a specific situation. This means that the artifact users' competence and skills in judging quality has a great impact on how the artifact is assessed. (p. 4)

The creation of a system which has good usability can be reached if the human-computer interaction specialists (HCI) consider a series of issue that regard both the physical and the digital sphere, having a look also to the cultural dimension (Preece *et al.* 1994). HCI should understand how people operate and make use of computer technology, being influenced by organizational, social and psychological factors. Through the case studies investigation, through the examination and comparing of eastern and western digital interfaces and interactive models, it was discovered that the advent of digital has decreed a flattening of the cultural component. Indeed, it was possible to observe a standardization of the interfaces and of the interactive models.

Phygital interaction

In the world above described where the virtual platforms, wearable technologies and distributed intelligence were the protagonists, the role of interaction designers has been directed to replicate everything we do in the real world into digital devices.

However, different trends emerge, in which it is possible to recognize how an inverse trend is prevailing: "digital detox" and distancing from the digital also due to the need to learn a new communication model. People are starting to move away from intrusive digital technologies, kicking off digital saturation.

The level of maturity of technological developments, the hyper-connectivity, the intensive research on augmented reality, Internet of Things and Artificial Intelligence are transforming our living spaces in digitally enriched environments where is even more difficult to distinguish the real from the simulated (Gaggioli, 2017).

In this direction, we are witnessing the emergence of a new phenomenon: phygital – a neologism that results from the synthesis of the terms "physical" and "digital". Phygital (Crick *et al.*, 2011) "concerns the overall connectivity phenomenon in which everyday objects are interlinked and connected to the environment, collecting information from it and adapting their performances". In this direction (Crick *et al.*, 2011), "physical and real do not simply complement but rather reinforce each other".

Considering that the possible ways in which the physical and digital worlds can be mixed are unlimited, is not easy to provide clarifying and explanatory examples. Nevertheless, is it possible to identify key characteristics and features of these ecosystems. Gaggioli argues that (2017):

A first property of these hybrid environments is that they are sensitive to the presence of people and aware of their situational context (context awareness): this is possible due to the integration of miniaturized computational infrastructures in everyday objects… These integrated sensors are connected via wireless network and can communicate (with bidirectional flow) to systems (actuators) capable of interpreting and processing the information collected in order to reduce human intervention, while improving the accuracy and ease of such activities. Another key aspect of phygital environments is that they enable natural interaction allowing people to control them via gesture, voice and movement. (p. 1)

Phygital experiences can also be described as a combination of both digital and physical key characteristics (Nofal, 2017).

Relevant key qualities from the digital world that the phygital experiences should include are:

. the immersion of information where the user may find himself thanks to the use of digital display technologies;
. customization of information, which can be offered or automatically filtered according to user profile.

From the physical world it is important to include:

. affordance, the physical form that demonstrates the consequences of an action;
. situatedness, engagement. which shows how information is based on the "physical context" to be understood;
. high level of engagement, which is one of the typical characteristics of physical experiences.

The scenario proposed implies new challenges for interaction designers. Adopting the phygital definition of Holstein (2017) "a digital layer of what you're experiencing in the real world" it is possible to understand how is important to stop thinking about technology as the end goal and start thinking and understanding how technology can enhance what customers do in their everyday life. The final output of this new experience is the result of an interdisciplinary approach with service designers, industrial designers, interaction designers, architects, ICT experts.

Also, to understand the cultural relevance inside the phygital interaction, case studies were analyzed as best practices belonging to five areas of interest (home&leisure, mobility, bank, retail, office) and were compared eastern (Japan and China) and western experiences on the basis of the product distribution.

The framework adopted for the analysis is represented in the picture below. Coherently with the theoretical research, were mapped also affordance, feedback, language sharing (if it was available the producer language only or more settings) and the minimalism.

Finally, it was defined how much the technology, or the shape plays a main role in the products/systems design.

As output, it was noticed the dominant role of technology in the definition and design of the product/system. Differently from the outputs of previous research, the differences between products coming from different geographical areas disappear. Moreover, high-level experiences in term of affordance, feedback and minimalism are offered. The cultural component seems to play and will play a major role.

How to design acculturated phygital experiences
In this new perspective, where the technology is no more the main protagonist, it is clear how much is important to reposition the user in the middle of the experience design, considering also their culture. The following graph describes the main drivers and elements to consider in designing a phygital experience, in order to accomplish this aim. Indeed, in this scenario, the user, who plays a new role, is required to interact, in a phygital dimension, with spaces and objects changing functions thanks to the possibilities allowed by technological developments.

Here, the technology is embedded in products and spaces and takes on different and unexpected combinations when it comes into contact, when it interacts with users more and more often through miniaturized technological components (the engine is in the wheels) and increased communicative elements.

All this must be designed from an ethical, aesthetic, conversational and above all from a cultural point of view. It is necessary to understand how to do it and which are the related implications.

This research work was carried out for NTT Data, an international technology company, to support them in the transition from an exclusively technological perspective to one that takes into consideration a design perspective. The intent of the guidelines was to transfer the value of a new cultural dimension to their employees.
Ethical implications:
. adopt a user center perspective. Users shape the experience, with their knowledge and culture, in this way the system become phygital adopting the third dimension (physical, digital and user-oriented). Users are the main driver of the process, while technology recognizes and adapts itself to them and not vice versa as often happens;
. declare both the role and the orientation of the technology. Adopting a process of feedforward, the user should easily understand the status and the adaption made by the system with a physical or digital evident feedback.
Aesthetical implications:
. qualify the aesthetical implication. It is important to underline in a qualitative way the aesthetical implication both form the interface and the architecture following the Rams principle from as little design as possible (Lovel, 2011);
. allow new forms of physicity. The physical evidence of products and systems become more and more relevant (McKinsey, 2017), so phygital spaces need new forms of mixed physicality where objects activate digital relations;
. make technology disappeared. Technology, aesthetically integrated and hidden in the products, will have to give the technological environment a humanized perspective.

Conversational implications:
. use the right tone of voice. Every culture needs a different and specific interface that the system should include;
. be conversational. It must be conversational in both linguistic and interaction models, adapting to different users.
Cultural implication:
. adapt the interaction to the cultural context. The technology has to be ready to adapt the physical and the digital format to the user's cultural context;
. adopting the ritual dimension. Each culture provides specific sequences of use that are self-explanatory for users coming from that culture. Adopting the ritual dimension can be a different way to interact and to engage the users in the processes;
. provide for interconnection. The digital world can vary from a collectivity dimension to a personal one and vice versa. In the next future, the importance of personal devices in managing the interaction will progressively decrease compared to this new interaction opportunities.

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AUTOMI

ROBOT
tutto meccanica

ANDROIDE
tutto meccanica
+ rivestito di
pelle umana

REPLICANTI
organismo sintetico
costruito de
tessuto organici
artificiale

CYBOR ← BIONICO
ibrido de
macchina e
organismo

ALIENO

artificializzazione
antropocentresmo

TORALDO DI FRANCIA

"Dobbiamo deciderci a riconoscere
che è legge biologica — dunque
naturale — che i topi siano
topicentrici, i gatti gattocentrici,
gli uomini antropocentrici. Guai se fosse
diversamente, nessuna specie si sarebbe salvata
della estinzione "

"disprezatori
del corpo"
Nietzsche

MINSKY
DE KERCKHOVE
MORAVEC

insieme di
organi risultante
di interventi
genetici

BIONICA scienza.
che studia gli organismi
viventi per costruire
modelli teorici e
pratiche che ne simulino
le funzioni tepiche "
Langevin :
RADAR
PIPISTRELLO

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The following is a list of the referees who have contributed to the DIID 2018 issues.

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01 Tomás Maldonado, Notes on the theme of artificialization of the body. The quote by Giuliano Toraldo di Francia is used in *Cultura, democrazia, ambiente. Saggi sul mutamento*, Feltrinelli, Milano 1990, p. 86. Courtesy Archivio Maldonado, Milano.